

<b>WASTE STREAM</b>	<b>9G104</b>	<b>Resin Vaults LLW</b>
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**SITE** Trawsfynydd  
**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Magnox Limited

**WASTE TYPE** LLW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	11.3 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2027.....	115.6 m <sup>3</sup>
Total future arisings:		115.6 m <sup>3</sup>
Total waste volume:		126.8 m <sup>3</sup>

Comment on volumes: The rate of arising of this stream will not be uniform over the period of Care and Maintenance Preparations.

Uncertainty factors on volumes: Stock (upper): x 1.1 Arisings (upper) x 1.2  
Stock (lower): x 0.9 Arisings (lower) x 0.8

**WASTE SOURCE** Plant from operation of RVs (Resin Vaults) 1, 2 and 3, their transfer pipe lines from RV 1,2 and 3 to the Resin Solidification Plant.

**PHYSICAL CHARACTERISTICS**

General description: Waste consists of predominantly metal - pipes, shielding, pumps, floor plates and de-planted equipment. Plastics including tanks, valves and pipework, wood, rubber and soft waste. Ion exchange resin (no more than 100kg), lubricating oil, vacuum bags (close weave glass fibre bags weighing 0.115g when empty and averaging 8kg of dust) from operational cleaning including concrete, paint, plaster and trace amounts of magnesium oxide.

Physical components (%wt): Metal (58%), concrete/rubble (5%), biodegradable - non-putrescibles (1%), plastics (20%), rubber (2%), wood (5%), other organic (6%) and other materials (3%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 0.46

Comment on density: WCH mass divided by volume

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (58%), concrete/rubble (5%), biodegradable - non-putrescibles (1%), plastics (20%), rubber (2%), wood (5%), other organic (6%) and other materials (3%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Most tritium is expected to be present as water but some may be in the form of other inorganic compounds or as organic compounds.  
C-14: Carbon 14 will probably be present as graphite.  
Se-79: The selenium content is insignificant.  
Tc-99: The technetium content is insignificant.  
Ra: Radium isotope content is insignificant.  
Th: The thorium content is insignificant.  
U: Uranium isotope content is insignificant.  
Np: The neptunium content is insignificant.  
Pu: Chemical form of plutonium isotope has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Not assessed.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	11.4	Pumps, pipework, sheilding blocks de-plant items	
Other ferrous metals.....	46.6	Pump sections of contaminated steel from shield blocks and floor plates, pipes and flanges de-plant equipment.	
Iron.....			
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....	~0.01	Lead contained with the paint dust (approximately 1% of the paint dust is lead )	
Magnox/Magnesium.....			
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....			
Zircaloy/Zirconium.....			
Other metals.....			
Organics (%wt):	The waste contains non-halogenated plastic as polythene, halogenated rubber as neoprene and non-halogenated rubber as silicone.		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	6.0		
Paper, cotton.....	1.0		
Wood.....	5.0		
Halogenated plastics .....	10.0	Soft waste, gland seal water tank, pipework, valves , liners & packaging	
Total non-halogenated plastics.....	9.6		
Condensation polymers.....			
Others.....	9.6	Soft waste, gland seal water tank , pipework, Tyvek coverall, sheeting , sample pots, packaging & PPE	
Organic ion exchange materials....			
Total rubber.....	2.0		
Halogenated rubber .....	1.0	neoprene	
Non-halogenated rubber.....	1.0	silicone	
Hydrocarbons.....	3.6		
Oil or grease .....	3.6	Waste lubricating oils & Coating on takki rags (white mineral oil)	
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			

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Others.....

Other organics.....

Other materials (%wt):           Traces of graphite may be present.

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0.16	AW500 (0.07%), Lewatit (0.06%) trace amounts of IRN78, Zeocarb 225, A51, IE95 and CS100	
Inorganic sludges and flocs.....			
Soil.....			
Brick/Stone/Rubble.....	5.0	Concrete/rubble	
Cementitious material.....			
Sand.....			
Glass/Ceramics.....			
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....			
Free non-aqueous liquids.....			
Powder/Ash.....	4.3	Concrete dust (1.88%), Paint dust (0.78%), plaster dust (1.57%), magnesium oxide dust (0.08%) in vacuum bags	

Inorganic anions (%wt):           Fluorides, chlorides, carbonates, phosphates and sulphates are present in trace quantities.

	(%wt)	Type(s) and comment
Fluoride.....	TR	
Chloride.....	TR	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	TR	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	TR	
Sulphate.....	TR	
Sulphide.....	0	

Materials of interest for  
waste acceptance criteria:           -

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	(%wt)	Type(s) and comment
Combustible metals.....		
Low flash point liquids.....		
Explosive materials.....		
Phosphorus.....		
Hydrides.....		
Biological etc. materials.....		
Biodegradable materials.....	1.0	
Putrescible wastes.....		
Non-putrescible wastes.....	1.0	Paper and cardboard
Corrosive materials.....		
Pyrophoric materials.....		
Generating toxic gases.....		
Reacting with water.....		
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / -  
non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....		
Vanadium.....		

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Mercury compounds.....  
 Others.....  
 Electronic Electrical Equipment (EEE)  
   EEE Type 1.....  
   EEE Type 2.....  
   EEE Type 3.....  
   EEE Type 4.....  
   EEE Type 5.....

Complexing agents (%wt):      Yes

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....	0.08	Decon-90
Total complexing agents.....	0.08	

Potential for the waste to contain discrete items:      Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs Large Concrete Items (LCIs) may be DIs; drummed (ungrouted)/"rubbleised" wastes assumed not DIs

**TREATMENT, PACKAGING AND DISPOSAL**

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	7.2
Supercompaction (HFC)	Off-site	7.2
Incineration	Off-site	48.0
Solidification		
Decontamination		
Metal treatment	Off-site	7.3
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		37.5

Comment on planned treatments:

22.2% of the stream is planned for disposal as VLLW to landfill

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	22.5	0.46
Expected to be consigned to a Landfill Facility	22.2	0.46
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	48.0	0.40
Expected to be consigned to a Metal Treatment Facility	7.3	1.4
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility:      17 04 05, 17 02 03

**Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):**

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Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

**Opportunities for alternative disposal routing:** -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

**Waste Packaging for Disposal:**

Container	Stream volume %	Waste loading m <sup>3</sup>	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO	~7.2	~43.2	< 1
1/2 Height IP-2 Disposal/Re-usable ISO	~15.3	10	2
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: Data has been presented as though the waste will be in dedicated containers. It is likely that this waste will be placed in a container with other LLW. 43.2m<sup>3</sup> loading volume is calculated based on the fact that you can low force compact two times the normal volume of waste into a 200 litre/0.2m<sup>3</sup> drum (400 litres/0.4m<sup>3</sup>), you can then fit 36 drums (14.4m<sup>3</sup>) into a ½ height ISO, each drum can be super-compacted to a 1/3 of its original volume so therefore we can get 3 x the amount of un-compacted drums into the final disposal container (43.2m<sup>3</sup>).

**Waste Planned for Disposal at the LLW Repository:**

Container voidage: Significant in-accessible voidage is not expected.

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC). The waste has a current WCH. Inventory information is consistent with the current WCH.

Waste consigned for disposal to LLWR in year of generation: Yes.

**Non-Containerised Waste for In-Vault Grouting:** (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume: -

Inaccessible voidage: -

Other information: -

**RADIOACTIVITY**

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Source:	Activity is from a mixture of fission and activation products and actinides. Tritium is also present.
Uncertainty:	The values quoted are derived from available measurements and are indicative of the activities to be expected.
Definition of total alpha and total beta/gamma:	Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.
Measurement of radioactivities:	Data taken from WCH - 1MXN-3TRA-0-WCH-0-4769 V3 decayed by two years for RWI 2022
Other information:	-

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	3.32E-07	CC 1	3.32E-07	CC 1	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	8E-09	CC 1	8E-09	CC 1	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36		8		8	Lu 174		8		8
Ar 39		8		8	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40		8		8	Hf 182		8		8
Ca 41		8		8	Pt 193		8		8
Mn 53		8		8	Tl 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55		8		8	Pb 210		8		8
Co 60	3.51E-09	CC 2	3.51E-09	CC 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	3.34E-08	CC 1	3.34E-08	CC 1	Po 210		8		8
Zn 65		8		8	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226		8		8
Kr 85		8		8	Ra 228		8		8
Rb 87		8		8	Ac 227		8		8
Sr 90	5.04E-05	CC 1	5.04E-05	CC 1	Th 227		8		8
Zr 93		8		8	Th 228		8		8
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94		8		8	Th 234	1.14E-09	CC 2	1.14E-09	CC 2
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99	1.79E-07	CC 2	1.79E-07	CC 2	U 232		8		8
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m		8		8	U 235		8		8
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238	1.14E-09	CC 1	1.14E-09	CC 1
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	1.93E-07	CC 1	1.93E-07	CC 1
Sn 123		8		8	Pu 239	1.95E-07	CC 1	1.95E-07	CC 1
Sn 126		8		8	Pu 240	2.52E-07	CC 1	2.52E-07	CC 1
Sb 125		8		8	Pu 241	4.44E-06	CC 1	4.44E-06	CC 1
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	5.17E-07	CC 1	5.17E-07	CC 1
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	8.99E-09	CC 2	8.99E-09	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	4.95E-04	CC 2	4.95E-04	CC 2	Cm 244	4.36E-09	CC 1	4.36E-09	CC 1
Ba 133		8		CC 8	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144		8		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	1.14E-09	CC 1	1.14E-09	CC 1	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	1.57E-08	CC 1	1.57E-08	CC 1	Other a				
Eu 152		8		8	Other b/g				
Eu 154	1.16E-08	CC 2	1.16E-08	CC 2	<b>Total a</b>	<b>1.16E-06</b>	<b>CC 1</b>	<b>1.16E-06</b>	<b>CC 1</b>
Eu 155	1.13E-09	CC 2	1.13E-09	CC 2	<b>Total b/g</b>	<b>5.50E-04</b>	<b>CC 1</b>	<b>5.50E-04</b>	<b>CC 1</b>

**Bands (Upper and Lower)**

- A a factor of 1.5
- B a factor of 3
- C a factor of 10
- D a factor of 100
- E a factor of 1000

Note: Bands quantify uncertainty in mean radioactivity.

**Code**

- 1 Measured activity
- 2 Derived activity (best estimate)
- 3 Derived activity (upper limit)
- 4 Not present
- 5 Present but not significant
- 6 Likely to be present but not assessed
- 7 Present in significant quantities but not determined
- 8 Not expected to be present in significant quantity